Ollscoil na hÉireann, Gaillimh ***GX_____***

National University of Ireland, Galway

Autumn Examinations 2009

Exam Code(s)	3IF
Exam(s)	3rd BSc in Information Technology
Module Code(s)	CT332
Module(s)	Database Systems II
Paper No.	
Repeat Paper	
External Examiner(s)	Prof. J. A. Keane
Internal Examiner(s)	Prof. G. Lyons
	Mr. C. O'Riordan

Answer ANY THREE questions

Instructions:

Duration

3 hours

No. of Pages	3
Department(s)	Information Technology

Requirements:

MCQ

Handout

Statistical Tables

Graph Paper

Log Graph Paper

Other Material

Q.1. i) Describe a procedure you might adopt to develop a relational schema from an EER diagram.

Explain how the process would differ if you were developing a schema suitable for an Object-Oriented Database.

Your answer should include a description of how you would deal with entities (strong and weak), attributes (atomic, composite, multi-valued), relationships (binary, n-ary, 1:1, 1:M, N:M), specialisations and categorisations.

Include examples to illustrate your explanation. (18)

ii) Illustrate, with an example, the types of data anomalies that can arise if a relation violates second or third normal form. (7)

iii) Given R = {A, B, C, D, E, F, G, H, I} and the following functional dependencies:

- $\{A,B,C\} \rightarrow \{D, E, F\}$
- $\{A,B\} \rightarrow \{G\}$
- $\{G\} \rightarrow \{B\}$
- $\{C\} \rightarrow \{H\}$
- $\{H\} \rightarrow \{I\}$

decompose R to a set of relations such that all relations satisfy BCNF. (8)

Q.2. i) Explain what is meant by *two-phase locking.* With a suitable example, show how the *incorrect summary problem* may arise in a system without suitable concurrency control measures in place. Show how the same schedule would proceed under a system operating under two phase locking. You may assume shared and exclusive locks. (10)

ii) Define the term *conflict-serializability.* Show that all schedules allowed under two-phase locking are *conflict-serializable*. (6)

iii) Explain, with respect to recovery, the importance of a *commit point* of a transaction. Explain, with an example, how the recovery mechanism would proceed in a system operating under the immediate update protocol. (9)

iv) Describe, with a suitable example, how the notion of a commit point may be extended to operate in a distributed database. (8)

Q.3 i) Given the following relational schema:

AUTHOR:	id, paper_id
PAPER:	paper_id, title, year, location
PROJECT:	pno, pname, desc
WORKS_ON:	pno, id

Develop an SQL queries to satisfy the following information need:

List all people who have written a paper in 2003 or 2004 or who work on a project name "Collab_Filtering" or "GP". (6)

ii) Describe the process of heuristic optimisation. Illustrate the process with the query developed in i). (12)

iii) Describe the structure and use of a B+tree. Describe an algorithm for the insertion of data items into a B+tree. Illustrate the operation of your algorithm with an example. Comment on the efficiency of a B+tree. (8)

iv) With respect to parallel databases, outline, with the aid of an example, suitable means to partition a relation. Comment on the suitability of these approaches for both range and point queries. (7)

Q.4.

i) Compare Object-Oriented, Object-Relational, and relational models – describe the differences in models and query languages supported. Your answer should also include the language constructs supported in the query languages associated with DBMSs adopting the models. (15)

ii) Describe the use of views in relational databases. Discuss, with examples, the view update problem and outline approaches that may be adopted to avoid this problem. (9)

iii) With respect to deductive databases, discuss briefly how queries are answered by the deductive databases. Comment on the expressiveness of the Datalog query language in comparison to SQL in a relational database. (9)